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Korrelative Analyse biogeochemischer und struktureller Komplexizität im Boden

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Titel
Contrasting soil organic matter properties of a Hawaiian Andosol revealed by fractionations procedures

Abstract
Volcanic Andosols are recognized by their strong capacity to accumulate soil organic carbon (SOC), and for presenting a singular aggregation pattern. However, the factors that govern their SOC storage and aggregation hierarchy are still poorly understood. In this way, the objective of this study was to evaluate the soil organic matter (SOM) properties of an Andosol through CN analysis, NMR spectroscopy, and scanning electron microscopy (SEM) with subsequent nano scale secondary ion mass spectrometry (NanoSIMS) analysis in the soil mineral fraction testing different fractionation methods. We tested three Andosol samples from two sites of the Kohala region – Hawaii with contrasting precipitation levels. The samples tested were as follow: 1784-60, 1784-80 and 2286-50 (precipitation - average depth in cm). We performed the SOM fractionation using ultrasonic dispersion at 1500 J ml^{-1}, wet sieving and sedimentation. The procedure was carried out in three sets: in deionized water, in 1M NaCL solution, and in polytungstate solution (SPT) 1.8 g cm^{-3}. Six fractions were obtained as follow: free particulate organic matter (fPOM), occluded particulate organic matter (oPOM), 4000-63, 63-20, 20-2 and < 2µm, respectively. Overall, the pre-dispersion treatment with NaCL saturation did not influence the C content and its distribution, as well as the SOM composition observed by NMR and NanoSIMS analysis. The oPOM fraction revealed great differences between the contrasting samples 1784-60 and 2286-50 in C content and SOM composition. More than 90% of the soil mass was concentrated in the fractions below 20 µm. The <2µm fraction was the most representative for the evaluated Andosol, accounting with 83% of the C content and 74% of the soil mass for the three samples evaluated overall. The 2286-50 presented a higher C content than the other samples especially for fPOM and the < 2 µm fraction. The 2286-50 sample presented overall a dominance of alkyl-C, while 1784-60 showed higher amounts of carboxyl-C and O/N alkyl groups, which can be explained by differences in the mineral composition of each sample. In addition, the NanoSIMS analysis demonstrated distinct spatial differences in the distribution of $^{12}C^-$ and $^{12}C^{14}N^-$ in organo-mineral associations at the micro scale between the two sites. The results of this study suggest that mineral interactions in the smaller size-fractions (<2µm) can be the key to explain the mechanisms of C storage in Andosols.